REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

More Emphasis Needed On Data Analysis Phase Of Space Science Programs

National Aeronautics and Space Administration

Scientific data acquired from NASA's space programs is not always promptly made available to the scientific community for further analysis and maximum benefit to the Nation.

The Congress should examine the adequacy of NASA's allocation of resources between gathering space science data and analyzing it.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report discusses the National Aeronautics and Space Administration's support of investigators' postlaunch data analysis efforts on space science experiments and improvements needed in making this data available to other members of the scientific community for further analysis.

This review is a follow-on to a survey in which we found that data on a number of successfully launched experiments had not been submitted to the National Space Science Data Center as required.

Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget, and to the Administrator, National Aeronautics and Space Administration.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

MORE EMPHASIS NEEDED ON DATA ANALYSIS PHASE OF SPACE SCIENCE PROGRAMS National Aeronautics and Space Administration

D I G E S T

When evaluating the National Aeronautics and Space Administration's (NASA's) program content and budget requests, the Congress should examine the adequacy of NASA's allocation of resources between gathering space science data and analyzing it. Greater emphasis is needed during the data analysis phase of a program to obtain the maximum scientific benefit from the data obtained.

BACKGROUND

NASA is responsible for developing and operating spacecraft to gather data on phenomena in space. It has invested billions of dollars on launch vehicles and satellites which transmit large quantities of space science data to Earth. Such data should increase our knowledge and further scientific exploration into such areas as the history of the universe, physics of the stars, and the search for life and other cultures.

NASA has structured its space science program primarily around individual scientists who are competitively selected from within NASA or elsewhere to carry out investigations. It enters into contracts or agreements with these scientists to do required work. These scientists, usually referred to as principal investigators, actively participate with NASA from the experiment's inception through the various operations' phases until the primary data analysis is completed and the processed or reduced data is placed in NASA storage.

Generally, the first step of an analysis is to receive from the satellite raw data which NASA gives to the principal investigator. The investigators change the raw data to reduced or processed data principally by compacting, editing, correcting, and merging operations. The reduced data provides the base from which other indepth studies can be done.

NASA policy requires the principal investigators to publish their findings as soon as practicable and make the reduced data records available for analysis by others.

The National Space Science Data Center is NASA's primary facility for acquiring and disseminating space science data to be analyzed by scientists other than the principal investigators and their coworkers. People using the Center are generally pleased with the quality of the data available there and the services provided. There is some concern, however, about the time it takes the principal investigators to submit reduced data to the Center for use by others.

WHY DATA IS NOT BEING SUBMITTED TO THE CENTER SOON ENOUGH

The Center has problems acquiring data promptly because some principal investigators fail to submit their data. This happens partly because of insufficient funding and the time allowed for their analyses. As a result, other investigators must either cancel or delay their work with this data or obtain it directly from the principal investigator or NASA field centers.

Data on 559 space science experiments, during 1966-73, should have been submitted to the Center by the time of GAO's review. The Center had not received data on 208 (37 percent) of these experiments; data has been submitted on the remaining 351 (63 percent). Also, based on the Center's general criteria of acquiring initial data within 2 years after launch, data from 165 (47 percent) of the 351 experiments was late by 6 months or more. However, GAO could not readily determine if the data for each experiment was complete.

Factors contributing to late data or data not received are:

--Contracts and written agreements which required investigators to submit data were not enforced. (See pp. 6 to 8.)

--Too little money and time were available to investigators for data analysis. (See pp. 11 to 13.)

--The Center was understaffed in relation to its mission. (See pp. 13 to 16.)

Center managers do not keep a schedule showing when investigators are expected to submit data from their experiments (see p. 7) and have provided little overall criteria for assigning priorities to the acquisition of this data. (See pp. 8 to 10.)

An alternative to increasing the Center's data acquisition staff is to expand the roles and responsibilities of NASA's space science project scientists to include data acquisition for the Center. They are already responsible for managing the scientific aspects of the projects and should be familiar with the data.

RECOMMENDATIONS

The Administrator of NASA should:

--Direct the Associate Administrator for Space Science to enforce the contracts and in-house agreements requiring investigators to submit data to the Center. (See p. 10.)

--Direct the Associate Administrator for Space Science to maintain a schedule showing when investigators are expected to submit data from their experiments and to set up a system showing which experiments should receive priority attention at the Center. (See p. 10.)

--Develop more realistic estimates of funds and time necessary to adequately support investigators' data analysis. (See p. 16.)

--Assign certain data acquisition duties to project scientists. (See p. 16.)

NASA agrees with GAO's recommendations and lists a number of corrective actions it plans to make. (See app. I.)

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ABBREVIATIONS

GAO	General Accounting Office
NASA	National Aeronautics and Space Administration

CHAPTER 1

INTRODUCTION

The National Aeronautics and Space Administration (NASA)--established by the National Aeronautics and Space Act of 1958 (Public Law 85-568, 72 stat. 426)--is responsible for arranging for the scientific community's participation in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conducting or arranging for the conduct of such measurements and observations. NASA is also responsible for providing the widest practicable and appropriate dissemination of information concerning its activities and results.

NASA's January 7, 1967, Policy Directive 8030.3 states its policy regarding space science flight experiments. It provides, in part, that NASA shall rely heavily on individual scientists in the United States (in and out of Government) to carry out complete investigations by (1) conceiving specific investigations; (2) developing, when appropriate, the instrumentation for the investigation; (3) participating actively, whenever possible, in the actual conduct of the investigation; (4) reducing 1/ and analyzing the data obtained; and (5) publishing their findings as soon as practicable and making the reduced data records available on a timely basis for use by others.

Under this policy the investigator dedicates many years to his investigation. For example, the prelaunch activities on the Orbiting Solar Observatory launched in 1975 took over 6 years and involved the design, development, and integration of the experiments into the satellite for launch. The postlaunch data analysis activity generally lasts an additional 2 or more years.

The selection of investigations begins once NASA has established a particular space science program. First, an Announcement of Opportunity is widely disseminated to interested scientific investigators. The announcement

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1/Generally, the first step of any analysis effort is to reduce the raw data. This typically includes compacting, editing, correcting, and merging operations. The reduced data should contain the basic information obtained from the experiment needed to independently analyze the data.

generally does not specify the investigations to be proposed, but solicits ideas which contribute to broad program objectives. According to NASA, the proposals received are distinctive and innovative. They are screened and competitively selected.

NASA field installations are assigned project management responsibilities for these investigations. Contracts are negotiated between the investigator's institution and the field installation or, in the case of foreign investigators, written agreements are negotiated with the sponsoring governmental agency in that country. These contracts and agreements specify the responsibility of the investigator (i.e., principal investigator) in developing the investigation to be launched, and for the postlaunch data reduction, analysis, and delivery of reduced data records and necessary documentation to the National Space Science Data Center (Center) at the Goddard Space Flight Center (Goddard).

The Center, established in 1964, has a mission to provide for the dissemination and analysis of space science data beyond that provided by the principal investigators. Consequently, it is responsible for the acquisition, organization, storage, retrieval, announcement, and dissemination of the scientific data obtained from satellites, sounding rocket probes, high altitude aircraft and balloons.

The schedule for delivery of data to the Center is negotiated between the investigator's institution and the cognizant NASA field installation. Experiments are generally designed to operate 1 or more years during which time data is being relayed to Earth. Center guidelines state that a typical time interval for the investigator to submit data received during the first 6 months of the experiment has been 2 years after launch. Data received during the next 6-month period is to be furnished to the Center within 2-1/2 years after launch and so forth.

Organization and management

The Associate Administrator, Office of Space Science, is responsible for the overall direction of the Center through the Director, Goddard Space Flight Center. Individual Headquarters program directors are responsible for managing the data reduction, primary analysis, and delivery of reduced data records to the Center from space science flight experiments under their auspices.

The Center is primarily a contractor-operated facility, staffed with about 82 contractor and 14 civil service personnel. The civil service staff is responsible for overall

management and direction, as well as acquiring appropriate data from the investigators and maintaining an interface with the scientific community.

The contractor is responsible for the development and operation of the Center's automated information system, which includes computers and related equipment needed to process, store, and retrieve data for which the Center is accountable. The contractor is also responsible for processing and completing all data requests the Center receives. The Center's fiscal year 1976 operational costs were $1,734,500.

Review objectives and scope

This report presents our observations on problems involved in the submission of processed space science data to the Center. Our review objective was to determine why reduced data was either not submitted to the Center or was submitted late. We also did limited work to determine the adequacy and usefulness of data and services provided by the Center.

Our review was made at the Center, Greenbelt, Maryland, and at NASA Headquarters, Washington, D.C. We interviewed NASA officials, examined records and reports, and sent questionnaires to scientists in the United States and other countries.

One questionnaire was sent to investigators, primarily principal investigators who participated in NASA space missions launched before July 1, 1973, and were responsible for submitting data to the Center. These investigators at the time of our review had had sufficient time to meet the Center's general criteria of submitting their initial data 2 years after launch. This questionnaire requested information on such areas as (1) the adequacy of funding and support for data analysis, (2) the investigators' willingness to submit data and/or problems hindering the submission of data to the Center, and (3) possible improvements in the data analysis effort and services provided by the Center.

Another questionnaire was sent to foreign and U.S. persons whose requests for data were filled by the Center during the period January 1, 1974, through April 30, 1975. In this questionnaire we sought opinions on the adequacy and usefulness of data and services provided by the Center and ways the Center might be more useful and responsive to the scientific community.

The questionnaires were mailed to 262 investigators and 473 requesters. We received responses from 198 (75 percent) of the investigators and 392 (83 percent) of the requesters. Results of the questionnaire sent to the principal investigators are included as appendix II. The results of the questionnaire sent to requesters are included as appendix III.

CHAPTER 2

SPACE SCIENCE DATA NOT BEING ACQUIRED BY THE CENTER IN A TIMELY MANNER

NASA has invested billions of dollars on launch vehicles and satellites including the scientific instruments which have transmitted large quantities of space science data back to Earth in the conduct of experimental investigations. Although information to readily determine NASA's total investment was not available, the following examples illustrate the growing cost of such experiments.

The Orbiting Solar Observatory launched in February 1965 contained 10 experiments costing an average of $400,000. A later satellite in this series was launched in 1975 with seven experiments at an average cost estimated at about $2 million. Further, the four experiments selected for the High Energy Astronomy Observatory to be launched in 1977 have been estimated to cost an average of about $7.1 million.

The increasing costs of developing space science experiments limits opportunities for investigators to participate as principal investigators on the experiments. Also, the cost is too expensive and the effort too detailed to merit repeating the principal investigator's work in changing raw data (i.e., data as returned from an experiment) to reduced data. Therefore, NASA policy requires the principal investigators to publish their findings as soon as practicable and make the reduced data records available on a timely basis for use by others.

The Center was established as NASA's primary facility to acquire and disseminate space science data for further analysis beyond that performed by the principal investigators and their coworkers. Responses to the user questionnaire showed users to be generally pleased with data quality and the Center's service. There was, however, some concern expressed about the time it takes principal investigators to submit reduced data to the Center.

LATE OR NONSUBMISSIONS OF DATA REDUCE THE CENTER'S EFFECTIVENESS

There were 559 space science experiments as of November 11, 1975, launched during 1966-73, for which principal

investigators should have submitted reduced data to the Center. The Center had not received data on 208 (37 percent) of these experiments; data has been submitted on the remaining 351 (63 percent) experiments. However, we could not readily determine the completeness of the data for each experiment. Also, based on the Center's general criteria of acquiring data within 2 years after launch, data on 165 (47 percent) of the 351 experiments was 6 months or more late.

The majority of respondees to the investigator questionnaire said they are not reluctant to submit their data to the Center. However, approximately one-half of the respondees said they consider their late submission of the data to be a problem (to varying degrees) to other users of the data in the general scientific community.

NASA officials consider the Center's mission to acquire and disseminate all data from scientific missions unattainable in light of the limited manpower and dollar resources. They stated that NASA is currently reassessing the Center's mission as a national facility to clearly define its proper role in the acquisition, dissemination, and archival of space science data. This reassessment is expected to be completed and implemented by fiscal year 1978.

NEED TO ENFORCE THE REQUIREMENT FOR SUBMISSION OF DATA BY PRINCIPAL INVESTIGATORS

NASA's January 7, 1967, policy directive 8030.3 requires all principal investigators to prepare and submit their data and results to the Center in accordance with a schedule to be negotiated between the principal investigator's institution and the project management center. The data submitted is to include background information needed to make the data usable by other scientists.

Under this directive each program director within headquarters program offices is responsible for submission of reduced data records to the Center from space science flight experiments for his program. At the same time, the NASA field installation assigned project management responsibility for these experiments is required to make sure that the contracts or written agreements negotiated between the principal investigators' institutions and the project management center specify these responsibilities, and that investigators on

these projects comply with the contracts or written agreements. The in-house NASA investigators, although not contractually bound, are required to submit data to the Center in accordance with the above policy directive.

A Center official stated that NASA infrequently uses the contractual commitment to exert pressure on investigators to submit their data to the Center. He said the Center prefers a cooperative approach in working with the investigators for the purpose of acquiring only good usable data rather than just any data to fulfill the commitments.

We believe the number of experiments for which data had not been submitted to the Center, or had been submitted late, indicates a need for stronger enforcement action by the contracting officer where a contract is used, and by NASA management when the investigator is a NASA employee. The Center leaves it up to the project office to initiate any enforcement action by the contracting officer or NASA management. The only part the Center has in this process is to have the acquisition scientist 1/ contact the investigator and arrange to examine the preliminary reduced data and determine how much, what kind, and in what format the data should be submitted. All other matters, including the funding necessary to accomplish this, are controlled by the project office.

Officials in one project office said the office is mostly involved in the experiments during the hardware development stage and other phases preceding launch; afterward, their involvement and monitoring drops off drastically. NASA officials have stated that the extent to which the investigators' postlaunch data analysis efforts are monitored by the project office varies from project to project. Some are very thorough; others are not.

Directive 8030.3 makes the Director of the Center responsible for compiling schedules showing the dates by which investigators on NASA flight projects should have submitted reduced data records to the Center. These schedules are to be based on information obtained from the installations charged with project management. This procedure

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1/The Center's Data Acquisition and Analysis Branch includes scientists trained in one or more of the related scientific disciplines and is responsible for acquiring essential data from experiments in the most appropriate form for the Center.

is not being done for all experiments. We believe the Center should prepare and maintain delivery schedules for the data required to be submitted to the Center and coordinate followup procedures with the project management centers to make sure investigators are notified when data is not submitted according to schedule. A decision should then be made as to the appropriate course of action to be taken.

NASA agrees that additional management emphasis should be placed on the postlaunch phase and cites the establishment of the Orbiting Satellite Project Office in January 1974 at Goddard as one means of dealing with this issue. This office is responsible for providing project management and technical direction for selected operating satellites. NASA believes this is resulting in improved enforcement of contract requirements.

We believe better coordination between the Center and the project management centers is needed to make certain that appropriate enforcement action is initiated in those cases where it is warranted. We believe a stronger enforcement of the investigators' contractual or in-house agreements to submit data to the Center will result in more timely submissions. NASA agrees.

Uniform criteria for assigning priority codes should be established

The acquisition scientists operate with minimum control or guidance from management. Each acquisition scientist determines which principal investigators to contact, how much data to collect, and the priority to assign to the data.

Basically, each scientist assigns top priority A to about five experiments for which data is nearly ready for submission or has recently been received, and which the acquisition scientist plans to give top priority attention. Priority B is assigned to about 15 other experiments on which the acquisition scientist works when time permits. The remaining experiments with potentially desirable data are placed in lower priorities. This almost automatically includes experiments in the prelaunch phase or those just recently launched.

As noted above, the highest priority is assigned when data is either at the Center or is about to be submitted. The determination as to which experiments receive the top priority is made by the acquisition scientist, but there are no uniform criteria for such decisions. Justifications

for top priority can vary from one acquisition scientist to another. They can be based on factors such as actual or anticipated request activity for the data or simply that the investigator has indicated his willingness and/or desire to submit data.

NASA officials said that the limitation of resources has forced NASA to make priority decisions that balance the cost of creating a reduced data archive against its potential use. NASA believes this approach to be cost effective since data that has been given priority for archiving at the Center has permitted the Center staff to complete the data requests of 97 percent of the requesters. In our opinion, however, this is not a true measure of the Center's capability to meet the scientific community's need for data because:

--Some unfilled data requests may not have been recorded. Center personnel said a rule of thumb is that if it takes less time to complete the request than it does to fill out the request form used to record data requests, the form will not be completed. An example is a telephone request for data that the Center representative knows is not available at the Center. Since it would not require any processing or other effort on the representative's part, the request would not be recorded.

--Additional requests might have been received from the scientific community if other data had been acquired or late data had been acquired in a more timely fashion. For example, approximately 23 percent of the respondees to our questionnaire said the Center is not their first choice as a data source. One reason cited was a desire to obtain the data sooner than it was available at the Center.

--Any assessment of the cost effectiveness of NASA's selection of data for archiving at the Center should not be based only on the number of requests filled, but should also take into consideration the amount of data at the Center that has never been requested or for which there has been only a limited number of requests.

If data is to be acquired from investigators on a priority basis, we believe the Center should establish a procedure to obtain more input from the scientific community, such as the National Academy of Science Space Science Board, in determining which experiments promise

the most desirable data. At the same time, we believe that if the acquisition scientist is to function properly, the high priorities should be assigned earlier in the data acquisition cycle so that the scientist can work more directly with the principal investigators in assuring that data is properly reduced and documented for timely submission to the Center.

RECOMMENDATIONS FOR NASA ADMINISTRATOR

We recommend that the NASA Administrator direct the Associate Administrator for Space Science to:

--Enforce the contractual and in-house agreements requiring investigators to submit data to the Center.

--Maintain a schedule showing when investigators are expected to submit data from their experiments.

--Set up a priority system to assure that acquisition scientists give appropriate attention early in the planning phases to those experiments that promise the most desirable data.

The above recommended changes are not the total solution. In the following chapter we discuss some of the underlying funding and staffing problems that significantly affect, in our opinion, the accomplishment of the Center's mission.

CHAPTER 3

NEED TO INCREASE DATA AVAILABILITY FOR FOLLOW-ON ANALYSIS

NASA, over the years, has not placed as much management emphasis on the data analysis efforts as it has on the prelaunch phase, according to 77 percent of the investigators responding to our questionnaire. About 80 percent of the investigators making this comment believe this has lessened the scientific accomplishment of NASA supported experiments.

INITIAL PROJECT OFFICE FUNDING OF PRINCIPAL INVESTIGATOR DATA ANALYSIS FOR MORE THAN 1 OR 2 YEARS SHOULD BE CONSIDERED

Experiments on NASA space flight missions usually are funded by project management offices (at NASA field centers) from project initiation through the early data analysis effort. Shortly before launch, principal investigators submit detailed data analysis plans, which NASA uses to negotiate the amount of money to be provided for data analysis. Approximately one-half of the investigators responding to questions on their planned scope and funding of data analysis said NASA usually reduces the scope and/or funding level of their analysis plans. Some of those responding in this manner believed the reductions were not justified and that this action degraded the experiment's scientific results.

A NASA official at headquarters said the investigators know what NASA's approved objectives are at the time the agreements are reached and the investigators agree that these objectives can be met within the stated funding and time constraints. He said the investigators usually plan a much greater data analysis effort than NASA believes can be justified. The responses to our questionnaire show the initial period of NASA's funding of data analysis has been approximately 1 or 2 years after launch in most cases. About 70 percent of the investigators said that this initial period was insufficient to process the data and achieve the experimental objectives.

Some of the reasons cited for the inadequacy of the initially funded period for primary analysis are:

--Investigators receive more data than anticipated from experiments.

--Delays in receiving data from NASA tracking and processing stations.

--Problems with the experiments' scientific instruments, spacecraft, or data reduction/analysis equipment.

--Failure to formulate an effective data reduction/analysis plan before receipt of first data.

Although principal investigators may publish the new, obvious results of space investigations within the initially funded period, indepth analysis and appropriate understanding of the meaning of the results may take up to 3 to 5 years. A 1972 NASA data management study showed that most publications containing comprehensive analysis of data appeared approximately 5 years after data acquisition.

Headquarters program offices may provide special budget funds for data analysis beyond the period of funding agreed to by the project office. The principal investigator, therefore, must submit a new proposal to NASA headquarters for review in competition with other scientists seeking funds from the data analysis budget line item. The preparation of additional proposals requires time and money that may take away from the ongoing data analysis effort. About two-thirds of the investigators answering our questionnaire said they have had to seek additional funds for one or more of their experiments--other than funds provided under the initial NASA contract--to complete their postlaunch data reduction/analysis. In the majority of cases, NASA Headquarters was the chief source of this funding.

We believe NASA, based on past experience, should initially plan to provide adequate funding of the investigators' analysis efforts through the project office. As noted earlier, the Center's guidelines give the investigator 18 months from the completion of each 6-month period, during which data is received from the experiment, to submit the required data to the Center. Therefore, it seems logical that NASA should plan to fund the data analysis effort on each experiment through the project office for a minimum of 18 months beyond the expected operational life of the experiment.

In May 1976 the Physical Sciences Committee of NASA's Space Program Advisory Council reached a similar conclusion on the planning of the data analysis effort. This Committee, at the request of the Associate Administrator for Space Science, conducted a detailed review of the policies and procedures of the Supporting Research and Technology/Data

Analysis Program in the Office of Space Science and concluded, in part:

> "* * * we also see the need for a more farsighted management of Data Analysis support. In most present flight programs, support linked to specific missions usually terminates one year after the completion of the mission; further interpretation of mission results, both by the original investigators and by other scientists, must thereafter be carried out under the [Supporting Research and Technology]/Data Analysis Program. We urge that adequate provision for the thorough analysis of data from any mission be made in connection with the planning of that mission."

Need for a better division of responsibility between project and acquisition scientists

The Center's Data Acquisition and Analysis Branch has been staffed at about half the level considered necessary by Center management to perform its mission. Because there are not enough acquisition scientists, and those available do not devote full time to the acquisition function, they have been unable to contact all investigators to obtain data contractually required to be submitted to the Center. In 1968 NASA planned for the Center to have 30 civil service personnel, including 22 acquisition scientists, by the end of fiscal year 1972.

Staffing problems and the resultant effects have existed in the Data Acquisition and Analysis Branch almost since the inception of the Center. As early as September 1968 the Center was having staffing problems. At that time the Director of the Center expressed concern to Goddard management that the Center has been stymied in attempting to grow to meet its mission requirements. This required assigning low priorities to the acquisition of a large amount of data.

Again in July 1973, responding to the question of what impact additional reductions in civil service ceilings would have on Center operations, the Director stated in part:

> "The staffing of NSSDC has dropped to such a low level that it is difficult to determine the effect of further reductions. Our acquisition staff is undermanned by more than a factor of two

and the data continues to pour in. At one time, we both agreed that 22 acquisition agents represented an adequate number to do the job. We have 8 full-time agents at the present, another is on assignment at NASA Headquarters until September 14, and still another is involved almost full-time in conducting radiation environment studies for the various project offices. Just the important spacecraft and experiments per agent average about 30 and 150, respectively, not to mention hundreds of other experiments which must be entered into our information system."

As of October 28, 1976, the Center had 14 civil service employees including 9 acquisition scientists.

Because of understaffing, the acquisition scientists have had to assume responsibility for more experiments than they can adequately manage. The result is that they cannot maintain effective contact with all the principal investigators who have commitments to submit data to the Center. On some experiments there has been little contact between the acquisition scientists and the principal investigator until data was either submitted to the Center or the principal investigator said he was about ready to submit data. More and more the acquisition scientist is relying on the initiative of the principal investigator to submit his data to the Center in a proper format and with proper supporting documentation.

The data acquisition problems caused by understaffing take on added significance when considering that two of the acquisition scientists came to the Center with commitments to other NASA activities. One performs considerable work on radiation environment studies, leaving only 20 percent of his time for data acquisition. The other is committed to spending about 50 percent of his time on the space telescope program. These individuals are, however, counted as full-time staff against the Center's staff ceilings.

The number of principal investigators who can be contacted is further limited because acquisition scientists spend, on the average, less than 50 percent of their time on acquiring, processing, and documenting space science data from investigators. Center management believes that,

to attract good scientists to data acquisition duties, it is necessary to permit them time to pursue independent research. To this purpose, NASA allows acquisition scientists to spend up to 40 percent of their time on research activities that focus on data products or system development which benefit the Center.

Those acquisition scientists that have done little or no disciplinary scientific research have, according to NASA officials, generally contributed in the development of useful file and report systems for the Center. Other activities on which the acquisition scientists spent time include work in support of data requests and on special publications, career development, and sporadic assignments to NASA Headquarters and/or Center working groups.

A part of the justification for having specialists acquire data for the Center is their scientific background. They understand the scientific aspects of the experiment and can work with the investigators to select appropriate data for submission to the Center with adequate documentation to permit other investigators to understand and use the data. The number of experiments for which data is to be submitted to the Center is placing a heavy burden on the limited number of acquisition scientists. As shown above, the acquisition scientist has been unable to contact and work with the principal investigator on some experiments to insure adequate and timely submission of data to the Center.

NASA officials take the position that

> "The Goddard Space Flight Center has been reduced in ceiling over the past several years and the whole scale of activities has been reduced."

They therefore believe it is only reasonable that the Center's staffing levels also be continuously reevaluated.

We believe, however, an alternative to hiring additional acquisition scientists for the Center is to expand the roles and responsibilities of NASA's space science project scientists to include the Center's data acquisition responsibilities. The current roles and functions of a project scientist, as outlined in NASA Management Instruction 7100.11 of June 20, 1975, include:

1. Managing the project's scientific aspects.

2. Being the scientific spokesman for the project and investigators.

3. Representing the principal investigator or team leader in their relationships with the project manager.

4. Maintaining the science integrity of the mission within the agreed time and funding constraints.

5. Maintaining cognizance of the individual as well as the overall science investigations included in the project.

6. Reviewing data analysis plans and programs to assure timely and adequate analysis of spacecraft data.

7. Assuring public dissemination of scientific results through professional groups and the public affairs office.

These activities place the project scientist in a very knowledgeable and advantageous position to also carry out the data acquisition responsibilities. He is in contact with the investigators and should be familiar with their experiments. He has to review the data analysis plans to insure timely and adequate analysis of the data. It logically follows that he should be in a position to work with the principal investigators to select appropriate data, make sure that it is sufficiently documented, and arrange for its timely submission to the Center.

The acquisition scientists would still be in a position to retain the overall responsibility for data acquisition in their particular disciplines. Shifting some of the acquisition responsibility to the project scientists might also allow the acquisition scientists at the Center to devote more time to compiling data and developing other data products that have proven useful to the scientific community.

RECOMMENDATIONS FOR NASA ADMINISTRATOR

We recommend that the NASA Administrator:

--Develop more realistic project planning estimates of funds and provide the time necessary to adequately support data analysis efforts of the principal investigators.

--Assign certain data acquisition responsibilities to project scientists.

RECOMMENDATION TO THE CONGRESS

NASA invests a great deal of money and effort in initiating programs that contribute to the work of many scientists and their institutions. If the United States is to obtain the full benefit of this effort, NASA must fulfill its responsibility of providing for the analysis and widespread dissemination of space science data.

When evaluating NASA's program content and budget requests, the Congress should examine the adequacy of NASA's allocation of resources between gathering space science data and analyzing the data. Greater emphasis is needed during the data analysis phase of a program to obtain the maximum scientific benefit from the data obtained.

AGENCY COMMENTS

NASA officials agree with our recommendations. They stated in part:

> "As the GAO report and our own analysis indicate, the principal cause of these delays in data acquisition is the lack of enforcement of existing regulations such as NMI 7100.11, NPD 8030.3, and NHB 8030.6. A joint Headquarters/Goddard review [latter part of 1976 and early 1977] of the situation led to a recent commitment to a new, more cost effective mode of operation of the NSSDC in which project and program scientists will have more direct responsibility for data acquisition and the establishment of priorities. They will be responsible for establishing with the Principal Investigators, data management plans and programs to assure adequate analysis of spacecraft data and timely submission of data and associated documentation to the Data Center. In the future, project plans will include a schedule for data submission to allow better planning and scheduling of data acquisition after launch. This new sharing of responsibility with program and project scientists will also increase the time that NSSDC staff collectively spend on data activities."

APPENDIX I

NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Attn of WG

March 1, 1977

Mr. Chester S. Daniels
Assistant Director
Procurement and Systems
Acquisition Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Daniels:

Reference is made to NASA's letter dated February 10, 1977, which enclosed comments on GAO's draft report entitled, "Need For More Emphasis On Data Analysis Phase Of Space Science Programs" (Code 952104).

In accordance with our telephone arrangements today, there are enclosed three copies of a restatement of the above-mentioned February 10 comments. Clarification and amplification of several individual comments were desirable and we deemed it to be more convenient to merge such changes into a complete restatement. Thank you for your willingness to consider these changes.

Sincerely,

Walter C. Shupe

Walter C. Shupe
Director, GAO Liaison Activities

Enclosure: A/S

GAO note: Page numbers in enclosures refer to a preliminary draft of this report.

APPENDIX I

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

COMMENTS ON

DRAFT OF REPORT TO THE CONGRESS OF THE UNITED STATES

NEED FOR MORE EMPHASIS ON DATA

ANALYSIS PHASE OF SPACE SCIENCE PROGRAMS

(CODE 952104)

The draft report indicates that the National Space Science Data Center (NSSDC) is not completely carrying out its stated mission in acquiring and disseminating space science data for further analysis beyond that performed by the principal investigators and their co-workers. The mission to acquire and disseminate all data from scientific missions including satellites, sounding rockets, high-altitude aircraft and balloons is extremely broad. It is a goal that is unattainable in light of the limited resources both in manpower and dollars since the establishment of NSSDC. We believe the current problem lies with the failure to define the true mission rather than failure to meet an unrealistic goal. To correct this, NASA is currently reassessing the mission of NSSDC as a National facility to clearly define its proper role in the acquisition, dissemination, and archival of space science data. It is expected that this reassessment will be completed and implemented by FY 1978.

Digest

We believe a more proper expression of NASA's mode of operation would be to substitute the following for the final sentence of the last paragraph

APPENDIX I

on page i: "NASA has structured its space science program primarily around individual scientists competitively selected to carry out complete investigations."

The report highlights several continuing problems NASA has experienced in the operation of NSSDC, but does not consider the recent efforts to correct the problems. A review of the situation will result in a commitment to a new, more cost effective mode of operation of the NSSDC in which project and program scientists will have more direct responsibility for data acquisition and the establishment of priorities. Future project plans will include a schedule for data submission which will allow better planning and scheduling of data acquisition after launch. The increased emphasis on planning and sharing of responsibilities with program and project scientists will result in greatly improved operation of the NSSDC.

Throughout the report the term "Center" is used to indicate NSSDC. This should be changed to eliminate any confusion between NSSDC and Goddard Space Flight Center.

To provide a balanced report, we feel that a summary assessment of the responses to the two questionnaires (mentioned on pages 5 and 6) should be added. Our assessment of the statistical results indicate that NSSDC is providing a necessary and effective service to the scientific community.

Space Science Data Not Being Acquired by NSSDC in a Timely Manner (Chapter 2)
The draft report correctly documents that space science data has not been acquired in a timely manner by NSSDC. We believe that while it is most

important to make full use of data returned from each scientific mission, we must balance the cost of creating a reduced data archive vs. its potential use. Within budgetary constraints the staff of NSSDC has made this evaluation. We believe this evaluation provides a cost effective system. That is, the data which has been given priority for archival through the collective judgment of the projects and the NSSDC staff has proved sufficient to meet the data requests of all but three percent (3%) of our requestors. The limitation of resources has forced NASA to make priority decisions regarding the most efficient use of resources.

We agree that stronger enforcement of contractual commitments will result in more timely submissions of data.

More Emphasis Needed on Data Analysis Phase of Space Science Programs (Chapter 3)

Page 13. The draft report states that NASA has placed more management emphasis on the pre-launch phase of its missions than it does on the post-launch data reduction/analysis phase. We believe that NASA provides proper management attention to data analysis during the planning phase of each project and focusses its management attention on hardware development problems during the pre-launch phase of each project. We agree that additional NASA management emphasis should be placed on the post-launch phase and, in January 1974, Goddard reorganized to deal, in part, with this issue by establishing the Orbiting Satellite Project Office which is responsible for providing project management and technical direction for

selected operating satellites. The sole responsibility of this Project Office is to manage satellites in the post-launch phase. A full time contracting officer has been assigned to this activity as part of the Business Management team and strict enforcement of contract requirements is not only feasible, but steadily improving. Coordination between the NSSDC and the Orbiting Satellite Project Office will identify those Principal Investigators who are delinquent in data submissions so that appropriate action may be taken.

Page 17. We believe a comment is in order on the GAO statement that "The (National Space Science Data) Center's Data Acquisition and Analysis Branch has been staffed at about half the level considered necessary by NSSDC management to perform its mission." The Goddard Space Flight Center has been reduced in ceiling over the past several years and the whole scale of activities has been reduced. It is only reasonable that the NSSDC plan also be continuously reevaluated.

Page 19. We also note that the draft report states that acquisition scientists spend "much of their time on activities other than data acquisition." Data Center management believes that to attract good scientists to data acquisition, it is necessary to permit time to pursue independent research. No scientist wants to just collect and store the data of others. It is true that up to 40% has been allotted for research activities but these activities are focussed on data product or system development which benefit NSSDC. Those acquisition scientists who have done little or no disciplinary scientific research have generally contributed in the

APPENDIX I

development of useful NSSDC systems such as the Technical Reference File, the Rocket File, Active and Planned Report, and the SIDS Report. The average breakout of time for the acquisition scientists has been as follows:

a. Acquisition, processing, and documentation of space science data - 21%

b. Searching for, reading, and keywording papers and reports for the Technical Reference File - 13% (This is part of the information acquisition.)

c. Preparing information on spacecraft, experiments, and data set entry into the AIM File - 13% (This is part of the information acquisition and processing.)

d. Work in support of data requests - 10%

e. Data synthesis and analysis and professional development - 17%

f. Work on special publications - 13%

g. Work on design and implementation of NSSDC system improvements - 13%

Consequently, we believe the citation of 40% for research activities is misleading. That 40% includes (e) above, data synthesis and analysis and professional development. This activity is one which is directly related to new data products and sciences of the NSSDC, and should not be considered a non-NSSDC related activity.

APPENDIX I

Conclusions and Recommendations

We agree with the recommendations in the draft report with one exception, that being that the responsibility for correcting any deficiencies should be the NASA program Associate Administrator rather than Project Management or Center Management.

As the GAO report and our own analysis indicate, the principal cause of these delays in data acquisition is the lack of enforcement of existing regulations such as NMI 7100.11, NPD 8030.3, and NHB 8030.6. A joint Headquarters/Goddard review of the situation led to a recent commitment to a new, more cost effective mode of operation of the NSSDC in which project and program scientists will have more direct responsibility for data acquisition and the establishment of priorities. They will be responsible for establishing with the Principal Investigators data management plans and programs to assure adequate analysis of spacecraft data and timely submission of data and associated documentation to the Data Center. In the future, project plans will include a schedule for data submission to allow better planning and scheduling of data acquisition after launch. This new sharing of responsibility with program and project scientists will also increase the time that NSSDC staff collectively spend on data activities.

The allocation of resources between gathering space science data and analyzing the data will be addressed in Congressional testimony.

Noel W. Hinners
Associate Administrator
for Space Science

3-1-77
Date

APPENDIX II

RESULTS OF
U.S. GENERAL ACCOUNTING OFFICE
SURVEY OF SPACE
SCIENCE INVESTIGATIONS

INSTRUCTIONS

Investigators working on space science experiments flown on NASA missions are usually required to reduce and submit the first six months of data they receive to the National Space Science Data Center (NSSDC) within approximately two years after the launch of the satellite.

According to NSSDC records, some data has not been submitted in a timely manner, and we are attempting to identify the reasons for the delays. NASA records indicate you have been assigned as a Principal Investigator (PI) on at least one experiment, and as such should be able to address the factors discussed in this questionnaire. However, if you were never a PI on a NASA experimental mission, or have never been required to submit data to NSSDC, or have always submitted your data on time, we would still appreciate your views to the extent possible.

Please read each question carefully and answer each as frankly and completely as possible based upon your overall experiences. Do not single out your best or worst experience; however, if you have been associated with only one experiment, please respond as best you can from that single experience.

Because you may have been involved in numerous space flight experiments and missions, we have structured our questions to apply to general or typical situations--not specific ones. Therefore, you may find it difficult in some cases to check only one response alternative when instructed to do so. However, one of the response alternatives is almost always more relevant to your general or overall experience than the others. Please mark that one and pardon us for forcing you to choose only one.

1. What has generally been your role or position with respect to NASA experiments you have been involved with? (Check one.) (See Note A p. 33.)

   /75/ Principal Investigator

   /18/ Co-Investigator

   /02/ Guest Investigator

   /01/ Data Analysis Team Member

   /02/ Spacecraft or Hardware Development Team Member

   /03/ Other (please specify) _____

   _____

2. What has been your primary organizational affiliation, while serving as an investigator? (Check one.)

   /14/ Federal Government, except NASA

   /00/ State Government

   /00/ Local Government

   /00/ Regional Agency

   /30/ NASA

   /05/ Industries

   /41/ Academic

   /00/ Foundation

   /07/ Federal Contract Research Center

   /03/ Non-profit

   /01/ Other (please specify) _____

   _____

APPENDIX II

3. Which discipline is most representative of the experiments on which you have been (are) an Investigator or Team Member (check one.)

/17/ Astronomy

/03/ Geodesy and Gravimetry

/05/ Geology

/09/ Ionospheric Physics

/03/ Meteorology

/31/ Particles and Fields

/08/ Planetary Atmospheres

/06/ Planetology

/09/ Solar Physics

/07/ Other (please specify) _____

_____

4. To date, on how many experiments have you been assigned, or otherwise assumed, the responsibility for submitting reduced (and analyzed) data to NSSDC, either as a Principal Investigator, Team Leader, etc.?

/19/ None (If none, go to question #7)

/26/ 1

/21/ 2

/12/ 3

/16/ 4-6

/05/ 7-10

/05/ More than 10

5. Provide a break-out for the total number of experiments cited in question #4 above on the following basis:

* approximate number of experiments required by NASA contract to submit data to NSSDC

_____ approximate number of experiments for which there was an oral agreement with NASA to submit data to NSSDC

_____ approximate number of experiments for which there was no firm NASA requirement to submit data to NSSDC, but felt obligation to do so

_____ other (please specify) _____

*See Note B p. 33.

How many of all these submissions have been completed to date? (Note: Consider a "completed" submission as: (1) a required submission which satisfied agreed-upon timeframes, volumes, etc.; or (2) one for which there was no firm requirement by NASA to submit but which you believe has sufficient data in NSSDC to be useful to others in the scientific community)

Number completed _____ (If all of them have been completed, go to question #7)

6. Please indicate the approximate number of submissions not yet completed associated with each of the reasons listed below for not submitting reduced and analyzed data.

NUMBER OF EXPERIMENTS NOT COMPLETED	REASON FOR NOT SUBMITTING
See Note B	Data not due to NSSDC yet
	Submission due, but experiencing data reduction and/or analysis problems
	Reduction and analysis complete but awaiting further instruction to submit
	No plans to ever submit
	Other (please specify) _____ _____ _____

APPENDIX II

7. Which of the following statements best describes your feeling toward submitting data to NSSDC? (Check one.)

/11/ Reluctant to submit because the time and money required to prepare data for NSSDC detracts from experimental effort

/11/ Reluctant to submit because of possibility that the data could be misinterpreted by other scientists and result in misleading conclusions

/02/ Reluctant to submit because of belief that experiment data should remain proprietary right of investigative team for a longer period of time

/72/ No reluctance to submit data

/05/ Other (please specify) _____

_____

DATA REDUCTION AND ANALYSIS

8. In general, have the data analysis proposals you submitted to NASA included the scope of work and funding amounts you believed were necessary to achieve the scientific goals you wished to investigate?

/67/ Yes

/33/ No

If not, why not? (check all that may apply)1/

/29/ Did not have available sufficient personal, equipment, facilities, etc., to complete the necessary level of effort

/02/ Technologies required were beyond the available state-of-the-art

/20/ Thought the scope of work was too large to gain NASA support

/53/ Thought that total project costs would limit the probability of obtaining NASA funding

/17/ Thought that the time required to accomplish all project activities would limit the probability of obtaining NASA funding

/20/ Other (please specify) _____

_____

1/Percentages total to more than 100 percent because multiple responses could be checked.

9. Typically, in obtaining NASA support, has the scope of work you originally proposed for data reduction and analysis activities been revised by NASA in any way? (check one)

/16/ Significantly decreased

/32/ Moderately decreased

/43/ No change

/08/ Moderately increased

/01/ Significantly increased

If so, what was (will be) the effect of such changes on the achievement of your proposed objectives? (check one)

/11/ Substantial improvement

/03/ Marginal improvement

/18/ Little or no effect

/38/ Marginal degradation

/30/ Substantial degradation

If any degradation occurred, do you believe the change was justified? (please comment)

See Note B

APPENDIX II

10. Typically, in obtaining NASA support, has the cost you originally proposed for data reduction and analysis activities been revised by NASA in any way? (check one)

/03/ Significantly increased

/09/ Moderately increased

/39/ No change

/30/ Moderately decreased

/19/ Significantly decreased

If so, what was (will be) the effect of such changes on the achievement of your proposed objectives? (check one)

/12/ Substantial improvement

/03/ Marginal improvement

/18/ Little or no effect

/34/ Marginal degradation

/34/ Substantial degradation

If any degradation occurred, do you believe the change was justified? (please comment)

See Note B

11. What has generally been the timeframe which NASA has agreed to fund you for post-launch data reduction and analysis, under your initial proposal? (check one)

/05/ Less than 1 year after launch

/33/ 1 year after launch

/44/ 2 years after launch

/07/ 3 years after launch

/00/ 4 years after launch

/01/ 5 or more years after launch

/09/ Other (please specify) _____

12. Has the timeframe indicated in Question #11 proven to be adequate time in which to process your data and achieve your experimental objectives?

/24/ Yes

/76/ No

If not, please indicate what you consider to be the time generally needed to do this? (check one)

/12/ 2 years after launch

/26/ 3 years after launch

/30/ 4 years after launch

/10/ 5 years after launch

/22/ Other (please specify) _____

13. If you answered "No" to Question #12, please cite the primary reason why more time is generally needed. (check one)

/10/ More data is received than anticipated

/04/ Instrument problems hinder analysis efforts

/05/ Spacecraft problems hinder analysis efforts

/15/ Delays in receiving data from NASA tracking and processing stations

/05/ Data reduction/analysis equipment problems hinder efforts

/05/ Effective data reduction/analysis plan not formulated before receipt of first data--which hinders efforts

/56/ Other (please specify) _____

APPENDIX II

14. Generally, what has been the funding source for the initial post-launch data analysis effort on your experiments? (check one)

/90/ NASA

/07/ Co-funding by NASA and your (or some other) organization or agency

/03/ Other (if you marked this box go to question #18(b) and indicate your primary source)

15. On the average, approximately what percentage of the total funding approved by NASA, i.e. under your initial experiment proposals, is represented by post-launch data reduction/analysis efforts? (check one)

(Note: If you received funding only for data reduction/analysis check this box /09/ and go to Question #17)

/09/ Less than 5%

/14/ 6 - 10%

/17/ 11 - 15%

/13/ 16 - 20%

/16/ 21 - 25%

/12/ 26 - 30%

/10/ More than 30%

16. Historically, what percentage of the total funding support received from NASA as well as other sources on your experiments (including follow-on efforts) is most representative of your post-launch data reduction/analysis efforts?

Note: If you have not yet completed the data reduction/analysis effort on any of your experiments, please provide your best estimate of the percent of total funds required to complete that phase. (check one)

/06/ Less than 5%

/09/ 6 - 10%

/13/ 11 - 15%

/12/ 16 - 20%

/20/ 21 - 25%

/15/ 26 - 30%

/26/ More than 30%

17. In general, how would you rate the adequacy of total funding provided by all sources for data reduction and analysis efforts? (Check one)

/00/ Significantly more than adequate

/01/ More than adequate

/35/ Adequate

/44/ Less than adequate

/19/ Significantly less than adequate

If not adequate, recognizing that any individual experiment will have a limited total budget, what percent of that budget do you believe should be directed specifically toward post-launch data reduction/analysis.

/* / / Percent
*See Note B

18.(a) Have you ever had to seek additional funds--other than funds provided under your initial NASA contract--in order to complete your post-launch data reduction/analysis?

/25/ Never (If this box is checked, go to question #20)

/03/ Rarely

/21/ Sometimes

/04/ As often as not

/15/ Generally

/15/ Almost Always

/17/ Always

(b) What has generally been the chief source of this funding? (check one)

/17/ NASA project office

/53/ NASA headquarters

/05/ National Science Foundation

/01/ National Oceanic and Atmospheric Administration

/07/ Department of Defense

/08/ Your past/present employer (other than above)

/04/ Other on-going experiments on which you were (are) an investigator

/04/ Other (please specify) _____

_____

APPENDIX II

19. Did these additional funds generally permit you to complete your post-launch data analysis effort?

/68/ Yes

/32/ No

20. With regard to the instrument and tracking (attitude, time, position, etc.) data you typically receive to analyze, how would you generally rate their:

(a) Quantity? (check one box for each column)

Instrument	Tracking	
/27/	/25/	More than enough data to achieve scientific objectives
/67/	/69/	Just about right amount of data to achieve scientific objectives
/06/	/06/	Too little data to achieve scientific objectives

(b) Quality? (check one box for each column)

Instrument	Tracking	
/42/	/38/	Very good
/46/	/43/	Good
/08/	/13/	Fair
/03/	/04/	Poor
/01/	/02/	Very poor

If the quantity received was more or less than necessary, explain the primary reason(s) or cause(s), if known.

See Note B

If the quality was poor or very poor, explain the reason(s) or cause(s), if known.

See Note B

21. How would you describe the time period NASA generally plans or allows between launches?

/25/ Most launches occur too close together to adequately analyze previous data and/or solve problems which could reoccur.

/53/ Most launches are spaced appropriately to allow ample time to analyze previous data and/or solve previous problems which could reoccur.

/09/ Most launches are spaced too far apart to adequately achieve mission objectives.

/12/ Other (please specify) _____

22. Would you say that NASA places (check one)

/01/ More emphasis

/14/ Equal emphasis

/80/ Less emphasis

/05/ No basis to judge

on the management of post-launch data reduction/analysis phase of its missions than it does on the pre-launch phase? If you marked "less emphasis" do you believe this has lessened the scientific accomplishments of NASA supported experiments?

/82/ Yes

/19/ No

Please provide any additional explanatory comments you may wish to make.

See Note B

APPENDIX II

23. Listed below are several important phases in space science experimental activities and some factors or problems which might cause significant post-launch reduction/analysis delays. If you have generally experienced any of these problems which resulted in a delay, place a check by the problem experienced under the appropriate phase in which it most typically occurs.

For example, if poor planning of the design or development of the instrument frequently causes problems and delays in post-launch data analysis efforts, place a check next to "Insufficient or poor planning" under the column headed "design, development, and test of instrument."

Please consider each factor or problem, and if you generally have not experienced it or it does not create delays in analysis efforts, cross out the item letter and go to the next item.

Reasons or Causes of Significant Data Reduction Analysis Delays	PHASE: Design, Development, and/or Test of Instrument	Design, Procurement, and/or Test of Data Reduction/ Analysis System	Quick-look Data Reduction/ Analysis	Prime Data Reduction/ Analysis	Follow-on Data Reduction/ Analysis
(a) Insufficient or poor planning	08	11	04	13	07
(b) Insufficient funds	07	10	01	26	38
(c) Not enough staff	07	10	03	28	23
(d) Inexperienced staff	03	08	03	10	05
(e) Inadequate facilities	02	02	02	07	03
(f) Insufficient computer support	01	02	03	14	11
(g) Too short a time period	07	07	04	23	16
(h) Excess quantity of data	00	01	01	08	06
(i) Poor data quality	01	02	07	11	05
(j) Late receipt of data	00	03	11	33	08
(k) Instrument operation problems	06	01	04	15	05
(l) Time and effort required to prepare follow-on proposals	03	01	01	11	18
(m) Spacecraft operation problems	04	01	05	15	07
(n) Poorly defined objectives	00	01	01	02	01
(o) Frequent work scope modifications, revisions	03	02	01	03	04
(p) Other (please specify) _____ _____ _____	02	02	02	07	05

APPENDIX II

24. For the problems you indicated in Question #23, select the three you consider the most significant and briefly provide any explanation and/or recommended solutions you believe would help to alleviate this type of problem in the future. Please indicate each problem with its appropriate letter in the brackets provided in the margin.

[ ] First most significant problem:

See Note B

[ ] Second most significant problem:

See Note B

[ ] Third most significant problem:

See Note B

25. THE NSSDC SERVICE

In 1965, NASA established the NSSDC with the objective of providing the widest practicable and appropriate dissemination of data obtained from space science investigations. To what extent do you believe NSSDC has achieved this objective? (Check one.)

/04/ Little or no achievement

/13/ Minimally achieved

/36/ Moderately achieved

/16/ Major achievement

/02/ Completely or almost completely achieved

/30/ No basis to judge

26. Whether or not the objective has been achieved, do you believe that NSSDC serves a useful scientific purpose from the standpoint of providing centralized archives for space science data?

/01/ Definitely no

/05/ Probably no

/04/ Undecided

/32/ Probably yes

/53/ Definitely yes

/05/ No basis to judge

27. Each of the items listed below deals with certain features of data which Investigators are required to submit to NSSDC. From your own experience, please rate each item as to whether you consider it to be a problem or not to the other users of such data in the general scientific community. (Check one box for each item)

	Little or no problem	Somewhat of a moderate problem	Moderate problem	Somewhat of a serious problem	Serious problem
a. The form and type of the reduced and analyzed data	45	21	13	13	09
b. The detail of the reduced and analyzed data	40	25	22	07	06
c. The detail of the supporting documentation submitted along with reduced and analyzed data	25	28	18	13	16
d. The time periods covered by the reduced and analyzed data	71	10	13	03	03
e. The timeliness of data submission to NSSDC	38	26	15	12	10
f. Other (please specify) See Note B					

APPENDIX II

28. Are there any particular types of activities, studies, information, etc., currently being done or available at NSSDC which you believe are not necessary?

/06/ Yes

/94/ No

If yes, specify what they are and why there is no need for them. _____

See Note B

29. Are there any types of activities, studies, information, etc. not currently being done or available at NSSDC which you believe would be useful to the scientific public?

/25/ Yes

/75/ No

If yes, specify what they are. _____

See Note B

ADDITIONAL COMMENTS

30. If you have additional comments on any of the questions or related points or topics not covered, please write your comments in the space below. Your views are greatly appreciated. Thank you.

41 percent commented (See note B)

NOTES:

A. Percentages are based on the actual number of properly marked responses to each question. The total of the percentages for each question will not necessarily equal 100 percent because of rounding--percentages ending in .5 or higher were rounded up to the next whole number, and those percentages ending in .4 or lower were rounded down to the next whole number.

B. Questions requiring written responses were not computer coded. Therefore these questions are not summarized.

APPENDIX III

RESULTS OF
U. S. GENERAL ACCOUNTING OFFICE
SURVEY OF REQUESTERS OF DATA FROM
THE NATIONAL SPACE SCIENCE DATA CENTER

INSTRUCTIONS:

Please read these questions carefully and answer each one as frankly and completely as possible. If the material you requested from the National Space Science Data Center (NSSDC)/World Data Center-A (WDC-A) was not intended to be used primarily for research and analysis purposes, please omit questions 20 and 21. If the material was requested for research and analysis purposes, please complete the entire questionnaire.

If you have submitted more than one request for material to the NSSDC/WDC-A, please respond to the questions from your overall general experience. Please don't single out either your best experience or your worst experience when responding. Think of your total experience and attempt to give a representative response. Naturally, if you have submitted only one request, please respond as best you can from that single experience.

1. When you requested data from NSSDC, what type of organization were you generally affiliated with? If affiliated with two or more, please indicate the primary organization. (Check one for section (a) and one for section (b).

   (a) Country: (See Note A p. 39.)

   /69/ United States /31/ Non-United States

   (b) Organization:

   /12/ Federal Government, except NASA
   /01/ State Government
   /00/ Local Government
   /00/ Regional Agency
   /12/ NASA
   /04/ Industries
   /57/ Academic
   /01/ Foundation
   /02/ Federal Contract Research Center
   /05/ Non-profit
   /06/ Other (please specify) _____

2. What is the most frequent use of the data you requested from NSSDC? (Check one.)

   /02/ Personal exhibit or display
   /02/ Professional exhibit or display
   /16/ Instructional material
   /10/ Reference material
   /67/ Research and analysis
   /03/ Other (please specify) _____

3. Approximately how many times have you requested data from the NSSDC? (Check one.)

   /23/ 1
   /48/ 2-5
   /18/ 6-10
   /06/ 11-20
   /05/ 21 or more

4. In which of the following data source categories and disciplines have you most frequently requested data? (Check one for section (a) and one for section b.)

   (a) Categories:

   /04/ Ground-based /01/ Rockets
   /01/ Models /00/ Balloons
   /01/ Computer Codes /89/ Spacecraft
   /00/ Aircraft /06/ Other (please specify) _____

   (b) Disciplines:

   /15/ Astronomy
   /02/ Geodesy and Gravimetry
   /10/ Geology
   /04/ Ionospheric Physics
   /07/ Meteorology
   /20/ Particles and fields
   /02/ Planetary Atmospheres
   /33/ Planetology (including geology, geo-physics, etc.)
   /04/ Solar Physics
   /04/ Other (please specify) _____

APPENDIX III

5. In what medium have you most frequently requested data? (Check one.)

/00/ Punched Cards

/17/ Digital Magnetic Tapes

/14/ Microfilm

/51/ Photographic Products (Prints, duplicates, etc.)

/04/ Computer Printout

/04/ Microfiche

/09/ Hard Copy (Text or report)

/01/ Other (please specify) _____

_____

6. How did you initially learn of the data and services available through NSSDC? (Check one.)

/26/ Friends (co-workers or others)

/14/ Technical Publications (including internal references)

/08/ Professional Societies, Conferences, etc.

/17/ NASA (mailing list or other)

/31/ Participation in NASA program

/04/ Other (please specify) _____

_____

7. Generally, what has been the primary source or means by which you have identified the specific data you have requested? (Check one.)

/02/ Documents Describing the Operation of NSSDC and WDC-A-R&S

/08/ NSSDC Announcements of Satellite Experiment Data Availability

/06/ NSSDC Data Announcement Bulletins

/03/ NSSDC Report on Active and Planned Spacecraft and Experiments

/25/ NSSDC Lunar and Planetary Catalogs and Users Guides

/05/ NSSDC Meteorological Data Catalogs and Users Guides

/01/ NSSDC Handbook of Correlative Data

/01/ NSSDC Spacecraft Program Bibliographies

/04/ WDC-A Catalog of Data

/00/ WDC-A Spacewarn Bulletin

/04/ Technical Publications

/22/ Personal contacts with NSSDC (Mail, Telephone, Face to Face, etc.)

/16/ Personal Contacts with Scientists, Investigators, etc. (Mail, Telephone, Face to Face, etc.)

/04/ Other (please specify) _____

_____

8. Have you encountered difficulty in using NSSDC/WDC-A documents or publications to identify and order data? (Check one.)

/15/ Yes /85/ No

If yes, what is the most frequent cause of this difficulty? (Check one.)

/06/ Inaccurate descriptions or explanations of data

/44/ Insufficient descriptive or explanatory information

/02/ Language too technical to understand

/00/ Language not technical enough

/32/ Information difficult to find in catalog (e.g., indexing problems)

/17/ Other (please specify) _____

_____

APPENDIX III

9. Excluding requests currently being processed, in which of the following manners has NSSDC most frequently processed or handled your requests? (Check one.)

/97/ By furnishing the data requested

/02/ Referred to alternative source(s) for data

/01/ NSSDC unable to fulfill request(s) or unable to recommend alternative source(s)

10. With respect to data obtained from NSSDC, what has been your general experience with the following:

a. Data received was: (Check one.)

/87/ exactly as requested

/11/ not as requested, but usable

/02/ not as requested and not usable

b. Receipt of data was: (Check one.)

/02/ much earlier than anticipated

/12/ earlier than anticipated

/63/ just about when anticipated

/18/ later than anticipated

/04/ much later than anticipated

c. Quality of data received was: (Check one.)

/39/ very good

/53/ good

/08/ fair

/01/ poor

/01/ very poor

d. Value of the data to my efforts has been: (Check one.)

/02/ little or no value

/06/ minor value

/18/ moderate value

/55/ substantial value

/19/ extreme value

11. For requests on which you have been referred to another source by NSSDC, were you generally able to obtain the data you needed from the alternative sources? (Check one.)

/80/ Never referred to alternative sources-- if you checked this box, skip to question number 13.

/08/ always or almost always

/08/ generally

/05/ never or almost never

12. Cite (in order of frequency of use) primary alternative sources for space science data you have been referred to by NSSDC.

1. See Note B p. 39.

2. _____

3. _____

13. When requesting space science or other experiment related data, is NSSDC generally your first choice as a data source?

/77/ Yes /23/ No

If no, please list (in order of frequency of use) those data sources you consider preferable to NSSDC and briefly explain the basis for your preference.

1. See Note B

2. _____

3. _____

APPENDIX III

14. What has been your most typical method of ordering and receiving data or information from NSSDC? (Check one each for part A, and B.)

A. Order:

/51/ Mailed letter request

/22/ Mailed Order Form

/22/ Telephone

/04/ Walk-in (ordered in person)

/02/ Other (please specify) _____

_____

B. Received:

/95/ Mail delivery

/04/ Picked up at NSSDC

/01/ Other (please specify) _____

_____

15. Of the data received on each request made to NSSDC, approximately how much of that data would you say you generally use? (Check one.)

/02/ none or almost none

/10/ about one-fourth

/17/ about one-half

/20/ about three-fourths

/51/ all or almost all

If all of it is generally not used, please indicate the primary reason for this. (Check one.)

/19/ Not all the data received was usable because of poor quality, insufficient back-up information, etc.

/32/ Ordered more data than was really needed

/15/ Received more data than requested

/33/ Other (please specify) _____

_____

16. On approximately how many of your requests have you been charged by NSSDC for the service supplied to you?

/10/ On all requests

/06/ On most requests

/07/ About half the requests

/11/ Very few of the requests

/67/ None of the requests

17. If in the future, requesters are required to pay the costs incurred in providing the service, (i.e., including only mailing, handling and reproduction costs), would you still use the service? (Check one.)

/87/ Yes /13/ No

18. To effectively use the data you receive from NSSDC (other than catalogs, bulletins, etc.), is it generally necessary to contact the scientist or investigator who reduced the data and placed it in NSSDC?

/17/ Yes /84/ No

If you checked no, skip to question number 20.)

19. Once you determined that it was necessary to contact the investigator for assistance, did you make contact in most cases? (Check one.)

/80/ Yes /20/ No

If yes, how helpful were these contacts in making the data usable for the purpose you intended? (Check one.)

/85/ Very helpful

/13/ Helpful, but not what needed

/02/ No help at all

If no, identify the reasons. (Check all that apply.)

/14/ Contact would inconvenience me

/14/ Contact would inconvenience the investigator

/57/ Did not know how to contact investigator

/00/ Investigator and/or staff members were not available

/00/ Investigator would probably be uncooperative

/14/ Other (please specify) _____

_____

APPENDIX III

20. Each of the items below deals with different features of the services and data offered by NSSDC(WDC-A). Identify any serious problems which have hampered or made impossible use of the data you requested; in other words, items that have caused significant cost increases, significant modification of the scope of work, or cancellation of efforts, etc.

Please consider whether each item is a significant problem or not. For each item you consider to be a significant problem, check one of the columns to indicate the frequency with which you have experienced it. If the item is not considered a problem, cross out the item letter, and go to the next item.

	Rarely	Sometimes	As often as not	Generally	Almost always	1/
a) Informing the potential user community of the service available	09	17	06	11	03	55
b) Explanation and classification of the data and information available	16	17	05	05	02	54
c) Providing other types of data-correlational or long term analysis	09	09	03	02	01	75
d) Cost to requesters	11	09	03	02	02	73
e) Speed of fulfilling requests	11	16	06	06	03	58
f) Information on availability of data	11	23	07	09	02	49
g) Data quantity	12	10	02	01	00	75
h) Data quality	14	17	05	02	01	62
i) Media data is available in	10	12	04	02	00	73
j) Format data is available in	09	14	05	01	02	69
k) Time coverage of the phenomena measured	07	14	05	03	02	70
l) Coverage--area and coordinates of data supplied	10	16	05	01	00	67
m) Quantity of back-up or supporting data including instructions for use	09	12	04	02	00	73
n) Quality of back-up or supporting data including instructions for use	09	13	05	02	01	70
o) Use of technical wording or language	12	09	01	01	00	77
p) Other (please specify) _____	01	00	02	02	01	94

1/ Not considered a problem

21. For the problems you identified in question 20, please select the three you consider the most significant and briefly provide any explanations and/or solutions you believe would help alleviate this problem in the future. Please indicate each problem with its appropriate letter in the brackets provided in the margin.

[ ] Most significant problem:

See Note B

[ ] Second most significant problem:

See Note B

[ ] Third most significant problem:

See Note B

22. As previously stated, NASA established the NSSDC with the objective of providing the widest practicable and appropriate dissemination of data obtained from space science investigations. To what extent do you believe NSSDC has achieved this objective? (Check one.)

/01/ Little or no achievement

/03/ Minimally achieved

/18/ Moderately achieved

/46/ Major achievement

/09/ Completely or almost completely achieved

/24/ No basis to judge

APPENDIX III

23. Whether or not the objective has been achieved, do you believe that NSSDC serves a useful scientific purpose from the standpoint of providing centralized archives for space science data?

/00/ Definitely no

/00/ Probably no

/01/ Undecided

/12/ Probably yes

/84/ Definitely yes

/02/ No basis to judge

24. Are there any particular types of activities, studies, information, etc., currently being done or available at NSSDC which you believe are not necessary?

/01/ Yes

/99/ No

If yes, specify what they are and why there is no need for them.

See Note B

25. Are there any types of activities, studies, information, etc. not currently being done or available at NSSDC which you believe would be useful to the scientific public?

/25/ Yes

/76/ No

If yes, specify what they are.

See Note B

26. Additional Comments

If you have additional comments on any of the questions or related points or topics not covered, please write your comments in the space below. Your views are greatly appreciated. Thank you.

25 percent commented (See Note B)

NOTES:

A. Percentages are based on the actual number of properly marked responses to each question. The total of the percentages for each question will not necessarily equal 100 percent--because of rounding--percentages ending in .5 or higher were rounded up to the next whole number and those percentages ending in .4 or lower were rounded down to the next whole number.

B. Questions requiring written responses were not computer coded. Therefore these questions are not summarized.

PRINCIPAL OFFICIALS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION RESPONSIBLE FOR ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
ADMINISTRATOR:		
Alan M. Lovelace (acting)	May 1977	Present
James C. Fletcher	Apr. 1971	May 1977
George M. Low (acting)	Sept. 1970	Apr. 1971
Thomas O. Paine	Apr. 1969	Sept. 1970
Thomas O. Paine (acting)	Oct. 1968	April 1969
James E. Webb	Feb. 1961	Oct. 1968
DEPUTY ADMINISTRATOR:		
Alan M. Lovelace	June 1976	Present
George M. Low	Dec. 1969	June 1976
Thomas O. Paine	Mar. 1968	Apr. 1969
Robert C. Seamans, Jr.	Dec. 1965	Jan. 1968
Hugh L. Dryden	Oct. 1958	Dec. 1965
ASSOCIATE ADMINISTRATOR FOR OFFICE OF SPACE SCIENCE: a/		
Noel W. Hinners	June 1974	Present
John E. Naugle (acting)	Mar. 1974	June 1974
John E. Naugle	Dec. 1971	March 1974
ASSOCIATE ADMINISTRATOR FOR OFFICE OF SPACE SCIENCE AND APPLICATIONS: a/		
John E. Naugle	Oct. 1967	Dec. 1971
Homer E. Newell	Nov. 1963	Oct. 1967
DIRECTOR, GODDARD SPACE FLIGHT CENTER:		
Robert S. Cooper	July 1976	Present
John F. Clark	May 1966	June 1976
John F. Clark (acting)	July 1965	May 1966
Harry J. Goett	Sept. 1959	July 1965

APPENDIX IV

	Tenure of office	
DIRECTOR, NATIONAL SPACE SCIENCE DATA CENTER:		
James I. Vette	Jan. 1967	Present

a/The Office of Space Science and Applications was reorganized and in December 1971 Space Science was established as a separate office.

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